

projection exposure apparatus includes the projection optical system and a light source supplying radiation having a natural linewidth that is incident on a linewidth narrowing unit to provide radiation for exposure having a linewidth narrower than the natural linewidth.

IN THE CLAIMS:

Please **CANCEL** claims 15 and 23.

Please **AMEND** claims 10, 16, 19, 22, 24, 27, and 30 as follows:

10. (ONCE AMENDED) An exposure apparatus transferring onto a substrate an image of a pattern on a mask, the apparatus comprising:

a light source emitting radiation having a natural linewidth;

a linewidth narrowing unit in the light source receiving the radiation having the natural linewidth and emitting radiation for exposure having a linewidth narrower than the natural linewidth;

an illumination optical system receiving the radiation from the light source and guiding the received radiation to the mask; and

a projection optical system forming on the substrate an image of the pattern on the mask in correspondence to radiation received from the mask, the projection optical system comprising one or more refractive optical members collectively comprising at least two fluoride substances, wherein

the at least two fluoride substances comprise a first fluoride substance and a second fluoride substance, and

each f -number FN_i of the one or more refractive optical members comprising the second fluoride substance satisfies a design condition of $0.8 < |FN_i|$.

16. (ONCE AMENDED) A projection exposure apparatus according to claim 14 wherein the linewidth of the radiation from the light source is not more than half of the natural linewidth thereof as measured on a full-width-at-half-maximum basis.

19. (ONCE AMENDED) A projection exposure apparatus according to claim 18 wherein the linewidth of the radiation supplied by the light source is not more than 0.3 μm as measured on a full-width-at-half-maximum basis.

22. (ONCE AMENDED) An exposure apparatus transferring onto a substrate an image of a pattern on a mask, the apparatus comprising:

a light source emitting radiation having a natural linewidth;

a linewidth narrowing unit in the light source receiving the radiation having the natural linewidth and emitting radiation for exposure having a linewidth narrower than the natural linewidth;

an illumination optical system receiving at least some of the radiation from the light source and guiding at least some of the received radiation to the mask; and

a projection optical system forming on the substrate an image of the pattern on the mask in correspondence to radiation received from the mask, wherein

the projection optical system comprises one or more refractive optical members collectively comprising at least two fluoride substances,

the at least two fluoride substances collectively comprise a first fluoride substance and a second fluoride substance with MX_1 being greater than MX_2 ,

a design condition $0.4 < \frac{MX_2}{MX_1} < 0.87$ is satisfied,

MX_1 is the effective aperture of the surface or surfaces having the largest effective aperture among the surface or surfaces of the refractive optical member or members comprising the first fluoride substance, and

MX_2 is the effective aperture of the surface or surfaces having the largest effective aperture among the surface or surfaces of the refractive optical member or members comprising the second fluoride substance.

24. (ONCE AMENDED) A projection exposure apparatus according to claim 10 wherein the linewidth of the radiation from the light source is not more than half of the natural linewidth thereof as measured on a full-width-at-half-maximum basis.

27. (ONCE AMENDED) A projection exposure apparatus according to claim 10 wherein the linewidth of the radiation supplied by the light source is not more than 0.3 μm as measured on a full-width-at-half-maximum basis.

30. (ONCE AMENDED) A projection exposure method for transferring onto a substrate an image of a pattern on a mask, the method comprising:

readying the mask for exposure;

readying the substrate for exposure; and

using the projection exposure apparatus according to claim 10 to form on the substrate the image of the pattern on the mask.

Please **ADD** the following claims:

31. (NEW) An exposure apparatus transferring onto a substrate an image of a pattern on a mask, the apparatus comprising:

a light source emitting radiation having a natural linewidth;

a linewidth narrowing unit in the light source receiving the radiation having the natural linewidth and emitting radiation for exposure having a linewidth narrower than the natural linewidth;

an illumination optical system receiving at least some of the radiation from the light source and guiding at least some of the received radiation to the mask; and

a projection optical system forming on the substrate an image of the pattern on the mask in correspondence to radiation received from the mask, wherein

the projection optical system comprises one or more refractive optical members collectively comprising at least two fluoride substances,

each of the refractive optical members within the projection optical system respectively comprises one or more fluoride substances,

the at least two fluoride substances collectively include calcium fluoride and barium fluoride,

the at least two fluoride substances collectively include a first fluoride substance and a second fluoride substance,

where MX_1 is the effective aperture of the surface or surfaces having the largest effective aperture among the surface or surfaces of the refractive optical member or members comprising the first fluoride substance,

MX_2 is the effective aperture of the surface or surfaces having the largest effective aperture among the surface or surfaces of the refractive optical member or members comprising the second fluoride substance,

MX_1 is greater than MX_2 , and

a design condition $0.4 < \frac{MX_2}{MX_1} < 0.87$ is satisfied.

32. (NEW) A projection exposure apparatus according to claim 31 wherein the projection optical system further comprises:

at least one positive lens component; and

at least one negative lens component, wherein

at least one of the positive lens component or components comprises the first fluoride substance, and

at least one of the negative lens component or components comprises the second fluoride substance.

33. (NEW) A projection exposure apparatus according to claim 32 wherein:

the at least two fluoride substances collectively include a first fluoride substance and a second fluoride substance; and

the f -number or the respective f -numbers of the refractive optical member or members comprising the second fluoride substance satisfies or satisfy the design condition $0.8 < |FN_i|$,

where FN_i represents each such f -number.

34. (NEW) A projection exposure apparatus according to claim 33 wherein the linewidth of the radiation from the light source is not more than half of the natural linewidth thereof as measured on a full-width-at-half-maximum basis.